April 4.

The President, Dr. Ruschenberger, in the chair.

Forty-nine members present.

On the Brains of Fishes.—Prof. Burt G. Wilder, of Cornell University, stated that his investigations on the brains of fishes had three objects: 1. To determine, by careful structural comparison, the extent to which such brains may be homologized with those of the higher vertebrates. 2. To see whether brain characters will enable us to define the limits of the group commonly known as Ganoids. 3. To ascertain how far brain characters, alone or in combination with heart characters, will serve for the characterization of all the more comprehensive subdivisions (classes or sub-classes) of Vertebrates.

During the last century fishes' brains have had at least five different interpretations. Their unsatisfactory nature may be inferred from the fact that Prof. Huxley, who generally clears up difficult subjects, makes no attempt in his Manual of Anatomy of Vertebrates to reconcile the figures and descriptions of fishes' brains either with each other, or with his admirable diagrammatic representation of the brain type, to which the brains of Batrachians, Reptiles, Birds, and Mammals are easily referred. He gives a figure of the brain of a typical Ganoid (*Lepidosteus* or "gar-pike"), but makes no allusion to it in the text.

Prof. Wilder believed that brains can be fully understood only by careful comparison of preparations made from fish *just taken from the water* and hardened in strong alcohol; that there should be several of each typical form, and embryos or young as well as adults; and that, instead of trusting to the outward aspect, the mesial surfaces should be examined and sections made at several points.

Finally, he believed it necessary to keep constantly in mind the typical brain as given by Huxley, and which he then briefly described.

By these methods he had been able, as he believed, for the first time, to find the clue to the homology of the two anterior pairs of lobes of the fish brain with parts of the brain of the higher Vertebrates.

The front pair of lobes have usually, though not always, been called olfactory lobes. In Myzonts or Marsipobranchs (lamprey eels, etc.), in Ganoids and some Teleosts as in the higher Vertebrates they are sessile; but in many Teleosts and most, if not all Selachians (sharks and skates) they are connected by elongated *crura* with the second lobes.

These latter are almost universally called *hemispheres.* Yet the essential features of hemispheres, namely, lateral ventricles and foramina of Monro, have never been found in the second pair of lobes of any fish-like form excepting those of the Dipnoans (*Lepidosiren*, *Protopterus*, and *Ceratodus*, the last just described by Huxley), which seem in most respects more like those of Batrachians than of fishes.[1] The second pair of lobes are either lateral solid laminæ joined below but with the upper borders more or less everted, as in Teleosts and Ganoids, or joined above also so as to inclose a cavity, as in Selachians. In either case the median space must be regarded as a forward continuation of the median or 3d ventricle and the lateral walls as anterior enlargements of the thalami. These enlargements Prof. Wilder proposes to call *prothalami;* in Selachians and some Ganoids they are connected by more or less elongated and depressed *crura thalami* with the optic lobes behind.

From the anterior part of the space between the prothalami and, in Ganoids and Teleosts, apparently in the base of the olfactory lobes, Prof. Wilder had found two openings leading into the cavity of the olfactory lobes. These openings he regarded as foramina of Monro, leading into distinct, though small, lateral ventricles.

He has found them in *Myxine* and *Petromyzon* (Myzonts); *Mustelus*, *Carcharias*, and other Selachians; *Acipenser*, *Polyodon*, *Amia*, and *Lepidosteus* (Ganoids), and *Perca*, *Scomber*, and *Anguilla* among Teleosts.

The true hemisphere of Ganoids may be represented by a raised lip of the foramen of Monro.

In an embryo *Mustelus* the anterior part of the brain is a single large vesicle with thin walls. From each side is a little bud which elongates to become the olfactory crus and lobe. By gradual thickening of the walls especially above, the single large cavity of the prothalamus becomes reduced to the two canals found in the adult brain near the ventral surface, which diverge forward from a median point to become continuous with the ventricles of the olfactory lobes. Prof. Wilder does not feel sure respecting the true hemispheres and the manner of their formation.

In the Teleost brains so far examined the foramina of Monro are much smaller than in the Ganoids; and where long olfactory crura exist they may be wholly obliterated in the adult. But if, as is anticipated, they are present in most Teleosts, then, so far as the brain is concerned, they may be distinguished from Ganoids only by the optic *chiasma* of the latter, as first suggested by Müller. To a careful comparison of the optic nerves in all fishes, therefore, attention should be directed.

[1] Since this paper was presented I have seen the paper of Paul Langerhaus (Untersuchungen über *Petromyzon Planeri* [*branchialis*], Freiburg, 1873), in which is given a figure showing the existence of ventricles in the hemispheres and olfactory lobes of the small lamprey.

The points above mentioned were illustrated by diagrams and specimens, also by tables of a provisional arrangement of vertebrates according to the modifications of the brain and heart.[1]

There is much to be done before fishes' brains can be fully understood. For instance, the brain of *Myxine* has not yet been satisfactorily homologized with that of *Petromyson*.

In conclusion, Prof. Wilder exhibited a *Chimera*, recently obtained through the kindness of Mr. Alexander Agassiz, Curator of the Museum of Comparative Zoology, the brain of which, so far as he had been able to examine it, presented a remarkable combination of characters, intermediate between those of Selachians, Ganoids, and Dipnoans. A full description with figures of the brain of *Chimera*, Prof. Wilder hoped to present to the Academy on a future occasion.

On Spessartite.—Dr. GEORGE AUG. KOENIG placed on record the analysis of *spessartite* from Yancey County, North Carolina. This interesting subspecies of garnet has heretofore been found at Haddam, Conn., as the only American locality. In the new locality it occurs in very large crystals, from six to eight inches long and three to four inches thick. The form is a distorted dodecahedron.

The crystals have a dark, almost black color at the surface, owing to a superficial decomposition, by which black oxide of manganese is formed. But in fragments the color is deep blood-red, turning to reddish-brown in thin plates. The latter are transparent and reveal no admixing mineral. Fracture conchoidal. Hardness nearly $=7$; gravity $=4.14$.

B. B. unaltered in oxidizing flame, and fuses to a black vitreous globule in point of blue flame. With borax in oxidizing flame dark blood-red bead, which turns dirty-green in reducing flame. With soda, fuses to a green glass. Hot and concentrated acids attack the powder, which is of a brownish color, but very slowly, and complete decomposition cannot be effected.

The very pure selected fragments yield by analysis—

		Oxygen.		Atoms.	
SiO_2	$=35.80$	19.092	19.092	0.599	17.06
Al_2O_3	$=19.06$	8.881	11.221	0.188	5.08
Fe_2O_3	$=6.25$	2.340		0.035	1.00
MnO	$=28.64$	6.351	8.698	0.384	10.97
FeO	$=9.49$	2.107		0.132	3.80
MgO	$=0.60$	0.240		0.015	
	99.84			O $=2.432$	69.7

[1] These with figures and descriptions of the brain of *Lepidosteus* are published in the Proceedings Am. Assoc. for Adv. of Science for 1875.

The oxygen ratio is $RO : R_2O_3 : SiO_2$—
1 : 1.28 : 2.19

and the atomistic formula is—

$$\left.\begin{matrix} {}^{IV}Si_{17} \\ {}^{VI}Al_3{}^{VI}Fe \\ {}^{II}Mn_{11}{}^{II}Fe_4 \end{matrix}\right\} O_{70}$$

It will be noticed that iron is contained in this garnet, both in the ferrous and in the ferric state, while in the analyses on record the iron is given as being all in the ferrous state. When those analyses were made, the method of decomposing minerals in strong sealed tubes at a high pressure was not known, and the mineral cannot be decomposed at the ordinary atmospheric pressure, as stated above. In heating the powder for thirty-six hours with acid containing 25 per cent. of sulphuric hydrate at 160° C., I succeeded in decomposing all but 7 per cent. The ferrous oxide obtained from the solution was then calculated pro rata for the undecomposed part, and the above result obtained.

To suppose that the presence of ferric iron is due to incipient alteration would not be justified, since no water was obtained by ignition, and the pellucidy of the mineral does not appear impaired. To explain the result of analysis the presence either of ferric oxide or manganic oxide must be admitted, which alternation would neither affect the oxygen ratios, nor the atomic composition.

I am indebted to Mr. Clarence Bement of this city for the material used in this investigation, and I hereby express my thanks for his kindness.

The thanks of the Academy were returned to Dr. James S. Gilliams for a portrait of the late Jacob Gilliams, one of the founders of the Academy, painted by Rothermell.

April 11.

The Rev. E. R. Beadle in the chair.

Thirty-four members present.

The following papers were presented for publication: "The Genus Pomoxys, Raf." By D. S. Jordan and H. E. Copeland. "Chemical Notes." By Geo. Hay.

Remarks on Arcella, etc.—Prof. Leidy remarked that the Rhizopods are so exceedingly polymorphous, that, to say the least of them, their specific and generic limits appear less well defined than in higher animals. In speaking of the Difflugian Rhizopods,